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(54) Water Circulator Device

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Canada

BACKGROUND OF THE INVENTION

The present invention relates to a circulator device for creating a flow of water, for example in a remote water body. More particularly, the invention relates to a circulation pump to be used in natural and man-made water bodies for water circulation for applications in temperature and water quality control, e.g. ice control, aeration and oxygenation, cooling, warming, mixing of chemicals and mixing of fertilizers.

Submersible pumps for creating circulation of water in water bodies are known in the prior art. Henegar Canadian Patent No. 1,031,584 issued May 23, 1978, for example, describes and illustrates a water circulating device for a lake, pond or reservoir in which a windmill supported on a flotation raft drives a propeller in a mixing chamber suspended in the water below the raft, the upper edges of the mixing chamber being located above the surface of the water. A pipe extends from the mixing chamber to the bottom of the lake. When the windmill drives the propeller, water is drawn upward from the bottom of the lake through the pipe into the mixing chamber, and is aerated as it spills over the upper edges of the mixing chamber. Cramer Jr. U.S. Patents Nos. 3,667,873 issued June 6, 1972 and 3,865,909 issued February 11, 1975, describe and illustrate high speed (3,000 to 3,500 r.p.m.) submersible motors driving propellers. The propellers direct

water in each case towards the downwardly pointing apex of an inverted conical structure to diffuse the water outwardly for removal of barnacles and the like (U.S. Patent No. 3,667,873) or for purposes of aeration (U.S. Patent No. 3,865,909). The motor and propeller of this latter Cramer, Jr. patent are suspended from a float member.

Cramer, Jr. U.S. Patent No. 4,014,526 issued March 29, 1977 describes and illustrates a liquid moving and mixing apparatus wherein a submersible motor is suspended from a float into a liquid, and drives a propeller beneath a diffusing member in which liquids to be diffused are introduced.

Springston U.S. Patent No. 4,302,162 issued November 24, 1981 describes a venturi-type water pumping device again having a submersible motor driving a propeller. The motor and propeller are held in a housing to be dropped to the level of the water where it is intended to pump water.

All of the above-noted patents, except Canadian Patent No. 1,031,584 of Henegar, appear to require, for their operation, electrical power from conventional sources such as power grids or generators.

It is an object of the present invention to provide a novel low energy consumption water circulator, designed for use at remote sites without access to conventional electrical power sources. It is a further object of the present invention to provide an effective and economical system for circulating water in man-made or natural water bodies.

SUMMARY OF THE INVENTION

In accordance with the present invention a low energy consumption water circulator device for creating a flow of water in a remote water body is provided. The device comprises a support raft which is to be supported on the water body. A number of photovoltaic panels are mounted on the raft to generate electrical energy. A DC motor is suspended from the raft in the water body, the motor receiving its power from the solar cell. A propeller, to be also immersed in the water body, is attached to the motor and is driven thereby at a low angular velocity thus creating a large, low velocity flow of water in the water body. An intake pipe is suspended from the raft and has an outlet end to be positioned close to the surface of the water body and an inlet end to be positioned close to the middle elevation depths of the water body. The propeller, during operation, is located in the intake pipe. A water circulation direction means is associated with the outlet end of the intake pipe to change the direction of the water leaving the outlet end of the pipe so that it reaches the surface of the water body and does not immediately plunge back downwards.

In a preferred embodiment of the present invention, the motor means is a DC motor which, by direct drive, turns the propeller at an angular velocity in the range of between 150 and 500 revolutions per minute. The water circulation direction means may be an inverted flow direction cone

positioned directly above the outlet end of the intake pipe or a slightly buoyant plastic sheet floating on the water just below the surface of the water and means directing water from the outlet end of the inlet pipe to the top of the plastic sheet.

Unlike many of the previously mentioned prior art aeration devices, applicant's device in accordance with the present invention is used primarily to break water stratification. This has many applications. For example, in situations where low oxygen is present in water, applicant's device may be used to stir water from the middle and bottom of a lake to the surface where oxygen exchange can take place. This may be important for the survival of fish in lakes where serious oxygen depletion may take place. As well, in cold climates, applicant's device may be used in winter months to prevent a lake from completely icing over by bringing warmer water from lower layers in the lake up to the surface and by creating a flow of water along the surface of the lake. This may be important in lakes where game fish such as rainbow trout exist, since, in winter months, dissolved oxygen in the water may become too low for such fish to survive after formation of complete icecap over the lake.

Other applications of applicant's water circulator device include its use in pumping cooler water from lower depths of the lake to the surface where, for example, pens of young fish may be held. Such fish often cannot survive in

warmer, surface water, for example when the surface water reaches a temperature in excess of 19° C. The device may also be used to stir injected pellets, fine powders or solutions of nutrients into pristine lakes, i.e. as a dispersal mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the invention will become apparent upon reading the following detailed description and upon referring to the drawings in which:

FIGURE 1 is a schematic section elevation view of an example embodiment of a water circulator device in accordance with the present invention;

FIGURE 2 is a schematic elevation view of an alternative embodiment of the present invention in position in a lake; and

FIGURE 3 is an exploded view of the motor and propeller of the water circulator device in accordance with the present invention.

While the invention will be described in conjunction with example embodiments, it will be understood that it is not intended to limit the invention to such embodiments. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE DRAWINGS

In the following description, similar features in the drawings have been given similar reference numerals.

Turning to FIGURE 1 there is illustrated a water circulator device 2 in accordance with the present invention. The device comprises an appropriate raft 4 upon which is supported a series of photovoltaic panels 6 as an energy source. Energy from photovoltaic panels 6, if not used directly, may be stored in an appropriate storage battery system 8 (phantom). Raft 4 is preferably appropriately anchored, e.g. by anchor means or on an ice sheet (in winter time). Suspended below raft 4 for example by cables 14 is an intake pipe 12 having a flared, lower inlet end 16 and an upper, outlet end 18. Intake pipe 12 is preferably made of steel and is positioned such that outlet end 18 is relatively close to the surface of the lake whereas inlet end 16 is close to the middle elevation depths of the body of water within which pipe 12 is suspended (see e.g. FIGURE 2). In normal circumstances, the length of this pipe may, for example, be 3 to 7 meters.

Suspended from platform 20 on raft 4, from bar or cable 22 is a DC motor 24 which derives its power from photovoltaic panels 6 or, as required, from storage battery 8. Motor 24 drives propeller blade 26 which, during operation, is positioned within the upper end 18 of pipe 12, to thereby

create an upwards flow of water through pipe 12. It is preferred that the propeller turn at low speeds, i.e. in the range of 150 to 500 revolutions per minute. This means that the motor may be operated at a fraction of its design speed and that the motor may be directly coupled to the propeller. (Alternatively the motor may be connected to the propeller by a gear reduction of about 3 to 1.) It is preferred, on the inside of the intake pipe 12, where the propeller 26 is located, to provide a constriction 28 to ensure that the gap between the propeller and the pipe is sufficiently small to cause good propeller performance and flow of water through pipe 12.

Electric DC motor 24 maybe either a submersible DC motor or a DC motor designed for in-air operation, the latter being illustrated in FIGURE 3. In this latter case, motor 24 is contained in a pressurized housing 30. The propeller shaft 32 turns against a spring loaded, free running "Teflon" (trade mark) ring seal 34, this preventing the air inside the housing from escaping. Air pressure within the housing is permanently established initially or is automatically maintained by a miniature cylinder 36 (phantom) of compressed gas located inside the housing. Cover 38 secures to one end of housing 30 to cover direct drive coupling 40 and seal 34.

Also suspended from cable 22, as can be seen in FIGURE 1, is a circulation direction means 44, consisting of an inverted flow direction cone with its apex positioned over

outlet end 18 of pipe 12. This cone ensures that the water leaving this outlet end 18 reaches the surface of the water body and does not immediately plunge back downwards.

The alternative embodiment of the present invention illustrated in FIGURE 2 is very similar to that of FIGURE 1, except that the circulation direction means, instead of being an inverted conical structure 44, is a slightly buoyant large plastic sheet 46 floating just below the surface of the water body. As can be seen in this drawing, circulated flow water leaving outlet end 18 of pipe 12 passes on top of this sheet thereby producing a proper circulation flow.

The device in accordance with the present invention is designed to run efficiently on very little power e.g. 25 to 250 watts. A very high efficiency of transfer of energy from power supplied to the electric motor to final power associated with the flow and velocity of water circulated is achieved. In FIGURE 2 the desired positioning of pipe 12 within a lake body may be seen, inlet end 16 being positioned towards the middle elevation depths of the body of water. A series of fish pens 50 can be seen in this drawing near the surface of the water to which cooler water (e.g. +12°C) from the depths of the water body is circulated to the surface (surface water temperature e.g. +22°C) by the device of the present invention.

Thus it is apparent that there has been provided in accordance with the invention a water circulator device that fully satisfies the objects, aims and advantages set forth

above. While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications and variations as fall within the spirit and broad scope of the invention.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A device for creating a flow of water in a remote water body, the device comprising:

(a) a support raft to be supported on the water body;

(b) a number of photovoltaic panels mounted on the raft to generate electrical energy;

(c) a motor means DC motor to be suspended from the raft in the water body, the motor means to receive its power from the photovoltaic panels;

(d) a propeller, to be immersed in the water body attached to the motor means and to be driven thereby at a low angular velocity thereby to create a large, low velocity flow of water in the water body;

(e) an intake pipe to be suspended from the raft and having an outlet end to be positioned close to the surface of the water body and an inlet end to be positioned close to the middle elevation depths of the water body, the propeller, during operation, to be located in the intake pipe; and

(f) a water circulation direction means associated with the outlet end of the intake pipe to change the direction of the water leaving the outlet end

of the pipe so that it reaches the surface of the water body and does not immediately plunge back downwards.

2. A device according to claim 1 wherein the motor means is a DC motor.

3. A device according to claim 2 wherein the DC motor is submersible.

4. A device according to claim 2 wherein the DC motor is designed for in-air operation but contained in a pressurized housing.

5. A device according to claim 4 wherein the pressure within the housing is automatically maintained by a cylinder of compressed gas located inside the housing.

6. A device according to claim 2 wherein the motor is directly connected to the propeller.

7. A device according to claim 2 wherein the motor is connected to the propeller by way of a gear reduction means of about 3 to 1.

8. A device according to claim 1 or 2 wherein the propeller turns at an angular velocity in the range of between 150 to 500 revolutions per minute.

9. A device according to claim 1 or 6 wherein the circulation direction means comprises an inverted flow direction cone positioned directly above the outlet end of the intake pipe.

10. A device according to claim 1 or 6 wherein the circulation direction means comprises a slightly buoyant plastic sheet floating on the water just below the surface of the water and means directing water from the outlet end of the inlet pipe to the top of the plastic sheet.

11. A device according to claim 1 wherein the diameter of the inlet pipe is constricted in the region where the propeller is situated during operation.

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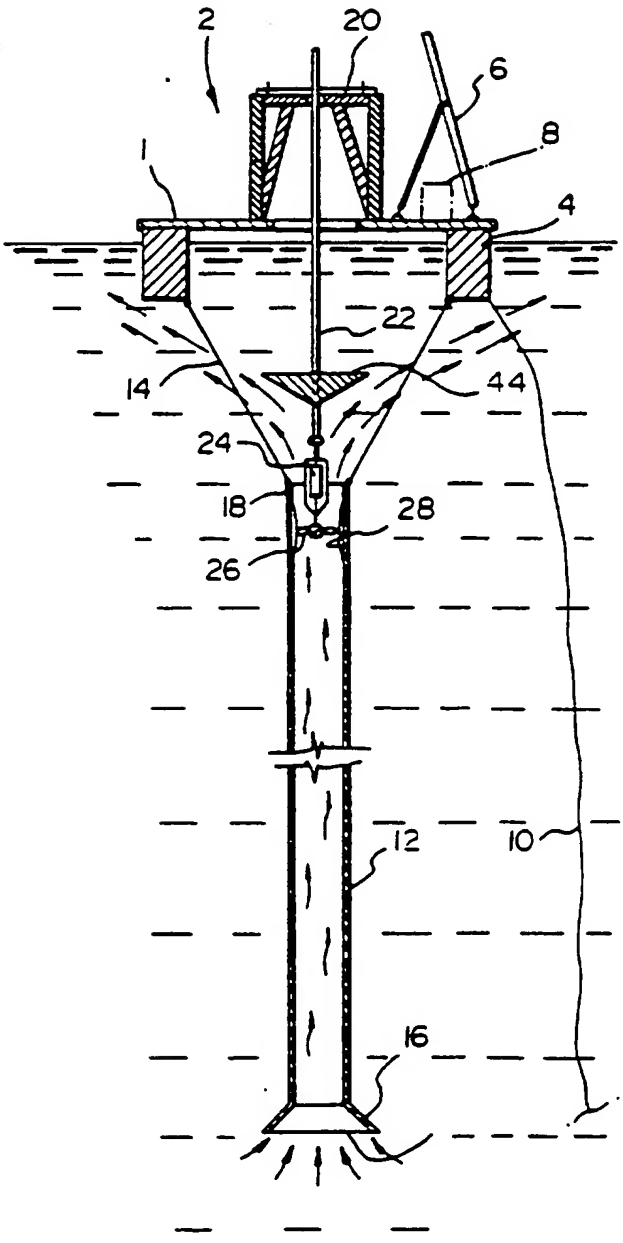

FIG. 1

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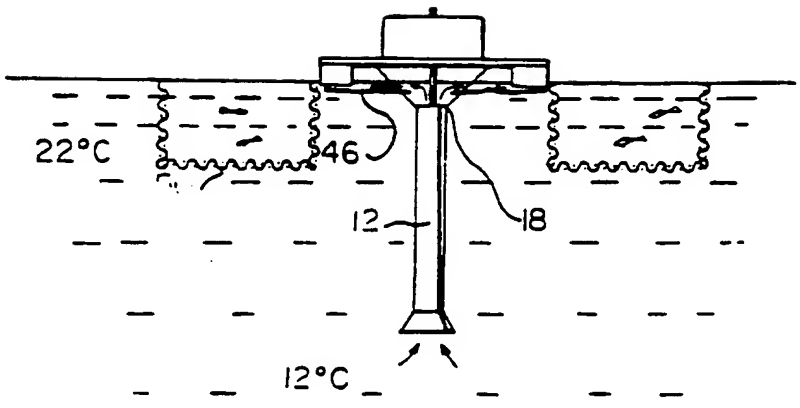

FIG. 2

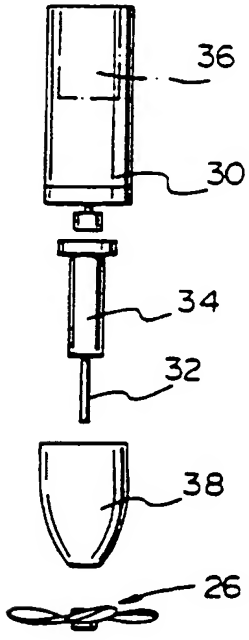

FIG. 3

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